



AmPT/1-

SEQUENCE LISTING

<110> Tuomanen, Elaine I  
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Johnson, Leslie S.  
Koenig, Scott

<120> POLYPEPTIDE COMPRISING THE AMINO ACID OF AN N-TERMINAL  
CHOLINE BINDING PROTEIN A TRUNCATE, VACCINE DERIVED  
THEREFROM AND USES THEREOF

<130> 5853-2

<140> 09/056,019

<141> 1998-04-07

<160> 40

<170> PatentIn Ver. 2.0

<210> 1

<211> 406

<212> PRT

<213> Streptococcus pneumoniae

<400> 1

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Arg Asp Lys Ala Arg Lys Glu Val Glu Glu Tyr Val Lys Lys Ile Val  
35 40 45

Gly Glu Ser Tyr Ala Lys Ser Thr Lys Lys Arg His Thr Ile Thr Val  
50 55 60

Ala Leu Val Asn Glu Leu Asn Asn Ile Lys Asn Glu Tyr Leu Asn Lys  
65 70 75 80

Ile Val Glu Ser Thr Ser Glu Ser Gln Leu Gln Ile Leu Met Met Glu  
85 90 95

Ser Arg Ser Lys Val Asp Glu Ala Val Ser Lys Phe Glu Lys Asp Ser  
100 105 110

Ser Ser Ser Ser Ser Ser Asp Ser Ser Thr Lys Pro Glu Ala Ser Asp  
115 120 125

Thr Ala Lys Pro Asn Lys Pro Thr Glu Pro Gly Glu Lys Val Ala Glu  
130 135 140

Ala Lys Lys Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys  
145 150 155 160

RECEIVED

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CENTER 1600/2900

Glu Glu Asp Arg Arg Asn Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Glu  
 165 170 175  
 Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu  
 180 185 190  
 Leu Val Lys Val Lys Ala Asn Glu Pro Arg Asp Glu Gln Lys Ile Lys  
 195 200 205  
 Gln Ala Glu Ala Glu Val Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu  
 210 215 220  
 Lys Lys Ile Lys Thr Asp Arg Glu Glu Ala Glu Glu Glu Ala Lys Arg  
 225 230 235 240  
 Arg Ala Asp Ala Lys Glu Gln Gly Lys Pro Lys Gly Arg Ala Lys Arg  
 245 250 255  
 Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala  
 260 265 270  
 Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser Pro Ser  
 275 280 285  
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 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp  
 325 330 335  
 Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys  
 340 345 350  
 Glu Pro Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu  
 355 360 365  
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg  
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 <212> PRT  
 <213> Streptococcus pneumoniae

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 35 40 45  
 Gly Glu Ser Tyr Ala Lys Ser Thr Lys Lys Arg His Thr Ile Thr Val  
 50 55 60  
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 85 90 95  
 Ser Arg Ser Lys Val Asp Glu Ala Val Ser Lys Phe Glu Lys Asp Ser  
 100 105 110  
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 165 170 175  
 Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu  
 180 185 190  
 Leu Val Lys Val Lys Ala Asn Glu Pro Arg Asp Glu Gln Lys Ile Lys  
 195 200 205  
 Gln Ala Glu Ala Glu Val Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu  
 210 215 220  
 Lys Lys Ile Lys Thr Asp Arg Glu Glu Ala Glu Glu Glu Ala Lys Arg  
 225 230 235 240  
 Arg Ala Asp Ala Lys Glu Gln Gly Lys Pro Lys Gly Arg Ala Lys Arg  
 245 250 255  
 Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala  
 260 265 270  
 Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser Pro Ser  
 275 280 285  
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 290 295 300  
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr  
 305 310 315 320

Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp  
 325 330 335  
 Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys  
 340 345 350  
 Glu Pro Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu  
 355 360 365  
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg  
 370 375 380  
 Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu Asp Lys  
 385 390 395 400  
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 405 410 415  
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 420 425 430  
 Pro Lys Ala Glu Lys Pro Ala Asp Gln Gln Ala Glu Glu Asp Tyr Ala  
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 Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu Thr Gln Gln Gln Pro Pro  
 450 455 460  
 Lys Thr Glu Lys Pro Ala Gln Pro Ser Thr Pro Lys Thr Gly Trp Lys  
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 Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr Leu Asn Ser Asn  
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 Gly Ala Met Ala Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr  
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 545 550 555 560  
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 Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn  
 580 585 590  
 Gly Asp Met Ala Thr Gly Trp Val Lys Asp Gly Asp Thr Trp Tyr Tyr  
 595 600 605  
 Leu Glu Ala Ser Gly Ala Met Lys Ala Ser Gln Trp Phe Lys Val Ser  
 610 615 620

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<211> 284

<212> PRT

<213> Streptococcus pneumoniae

<400> 3

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Arg Asp Lys Ala Arg Lys Glu Val Glu Glu Tyr Val Lys Lys Ile Val  
 35 40 45

Gly Glu Ser Tyr Ala Lys Ser Thr Lys Lys Arg His Thr Ile Thr Val  
 50 55 60

Ala Leu Val Asn Glu Leu Asn Asn Ile Lys Asn Glu Tyr Leu Asn Lys  
 65 70 75 80

Ile Val Glu Ser Thr Ser Glu Ser Gln Leu Gln Ile Leu Met Met Glu  
 85 90 95

Ser Arg Ser Lys Val Asp Glu Ala Val Ser Lys Phe Glu Lys Asp Ser  
 100 105 110

Ser Ser Ser Ser Ser Ser Asp Ser Ser Thr Lys Pro Glu Ala Ser Asp  
 115 120 125

Thr Ala Lys Pro Asn Lys Pro Thr Glu Pro Gly Glu Lys Val Ala Glu  
 130 135 140

Ala Lys Lys Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys  
 145 150 155 160

Glu Glu Asp Arg Arg Asn Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Glu  
 165 170 175

Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu  
 180 185 190

Leu Val Lys Val Lys Ala Asn Glu Pro Arg Asp Glu Gln Lys Ile Lys  
 195 200 205

Gln Ala Glu Ala Glu Val Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu  
 210 215 220

Lys Lys Ile Lys Thr Asp Arg Glu Glu Ala Glu Glu Glu Ala Lys Arg



Glu Pro Arg Asp Glu Gln Lys Ile Lys Gln Ala Glu Ala Glu Val Glu  
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<210> 6  
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<213> Streptococcus pneumoniae

<220>  
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<210> 7  
<211> 376  
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<213> Streptococcus pneumoniae

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35 40 45  
Val Ala Leu Asn Ile Lys Leu Ser Ala Ile Lys Thr Lys Tyr Leu Arg  
50 55 60  
Glu Leu Asn Val Leu Glu Glu Lys Ser Lys Asp Glu Leu Pro Ser Glu  
65 70 75 80  
Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu Lys Phe Lys Lys Asp Thr  
85 90 95  
Leu Lys Pro Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu  
100 105 110  
Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr  
115 120 125

Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Phe Asp  
 130 135 140  
 Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys  
 145 150 155 160  
 Glu Ser Arg Asn Glu Gly Thr Ile Lys Gln Ala Lys Glu Lys Val Glu  
 165 170 175  
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg  
 180 185 190  
 Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Asp Ala Lys Leu Lys  
 195 200 205  
 Glu Ala Asn Val Ala Thr Ser Asp Gln Gly Lys Pro Lys Gly Arg Ala  
 210 215 220  
 Lys Arg Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn  
 225 230 235 240  
 Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser  
 245 250 255  
 Ser Ser Leu Lys Ser Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val  
 260 265 270  
 Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg  
 275 280 285  
 Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu Ile Ala Glu  
 290 295 300  
 Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu  
 305 310 315 320  
 Ala Lys Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Lys Ala Lys  
 325 330 335  
 Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr  
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 355 360 365  
 Asp Lys Val Lys Glu Lys Pro Ala  
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<210> 8  
 <211> 663  
 <212> PRT  
 <213> Streptococcus pneumoniae

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 35 40 45  
 Val Ala Leu Asn Ile Lys Leu Ser Ala Ile Lys Thr Lys Tyr Leu Arg  
 50 55 60  
 Glu Leu Asn Val Leu Glu Glu Lys Ser Lys Asp Glu Leu Pro Ser Glu  
 65 70 75 80  
 Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu Lys Phe Lys Lys Asp Thr  
 85 90 95  
 Leu Lys Pro Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu  
 100 105 110  
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr  
 115 120 125  
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Phe Asp  
 130 135 140  
 Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys  
 145 150 155 160  
 Glu Ser Arg Asn Glu Gly Thr Ile Lys Gln Ala Lys Glu Lys Val Glu  
 165 170 175  
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg  
 180 185 190  
 Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Asp Ala Lys Leu Lys  
 195 200 205  
 Glu Ala Asn Val Ala Thr Ser Asp Gln Gly Lys Pro Lys Gly Arg Ala  
 210 215 220  
 Lys Arg Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn  
 225 230 235 240  
 Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser  
 245 250 255  
 Ser Ser Leu Lys Ser Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val  
 260 265 270  
 Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg  
 275 280 285  
 Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu Ile Ala Glu  
 290 295 300  
 Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu  
 305 310 315 320

Ala Lys Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Lys Ala Lys  
 325 330 335  
 Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr  
 340 345 350  
 Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu  
 355 360 365  
 Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala  
 370 375 380  
 Thr Gln Pro Glu Lys Pro Ala Pro Lys Pro Glu Lys Pro Ala Glu Gln  
 385 390 395 400  
 Pro Lys Ala Glu Lys Thr Asp Asp Gln Gln Ala Glu Glu Asp Tyr Ala  
 405 410 415  
 Arg Arg Ser Glu Glu Glu Tyr Asn Arg Leu Thr Gln Gln Gln Pro Pro  
 420 425 430  
 Lys Thr Glu Lys Pro Ala Gln Pro Ser Thr Pro Lys Thr Gly Trp Lys  
 435 440 445  
 Gln Glu Asn Gly Met Trp Tyr Phe Tyr Asn Thr Asp Gly Ser Met Ala  
 450 455 460  
 Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn  
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 Gly Ala Met Ala Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr  
 485 490 495  
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 500 505 510  
 Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Ala Met Ala Thr Gly Trp Leu  
 515 520 525  
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 Thr Gly Trp Leu Gln Tyr Asn Gly Ser Trp Tyr Tyr Leu Asn Ala Asn  
 545 550 555 560  
 Gly Asp Met Ala Thr Gly Trp Leu Gln Asn Asn Gly Ser Trp Tyr Tyr  
 565 570 575  
 Leu Asn Ala Asn Gly Asp Met Ala Thr Gly Trp Leu Gln Tyr Asn Gly  
 580 585 590  
 Ser Trp Tyr Tyr Leu Asn Ala Asn Gly Asp Met Ala Thr Gly Trp Val  
 595 600 605  
 Lys Asp Gly Asp Thr Trp Tyr Tyr Leu Glu Ala Ser Gly Ala Met Lys  
 610 615 620

Ala Ser Gln Trp Phe Lys Val Ser Asp Lys Trp Tyr Tyr Val Asn Gly  
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 <212> PRT  
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 35 40 45  
 Val Ala Leu Asn Ile Lys Leu Ser Ala Ile Lys Thr Lys Tyr Leu Arg  
 50 55 60  
 Glu Leu Asn Val Leu Glu Glu Lys Ser Lys Asp Glu Leu Pro Ser Glu  
 65 70 75 80  
 Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu Lys Phe Lys Lys Asp Thr  
 85 90 95  
 Leu Lys Pro Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu  
 100 105 110  
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr  
 115 120 125  
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Phe Asp  
 130 135 140  
 Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys  
 145 150 155 160  
 Glu Ser Arg Asn Glu Gly Thr Ile Lys Gln Ala Lys Glu Lys Val Glu  
 165 170 175  
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg  
 180 185 190  
 Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Asp Ala Lys Leu Lys  
 195 200 205  
 Glu Ala Asn Val Ala Thr Ser Asp Gln Gly Lys Pro Lys Gly Arg Ala

210                      215                      220  
 Lys Arg Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn  
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 <211> 106  
 <212> PRT  
 <213> Streptococcus pneumoniae

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 Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu Ile Ala Glu Ser Asp Val  
                     35                      40                      45  
 Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu  
                     50                      55                      60  
 Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Lys Ala Lys Val Glu Ser  
   65                      70                      75                      80  
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<210> 11  
 <211> 107  
 <212> PRT  
 <213> Streptococcus pneumoniae

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 Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Phe Asp Val Lys  
                     35                      40                      45  
 Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu Ser  
                     50                      55                      60  
 Arg Asn Glu Gly Thr Ile Lys Gln Ala Lys Glu Lys Val Glu Ser Lys  
   65                      70                      75                      80

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Ala Glu Glu Glu Ala Lys Arg Lys Ala Asp Ala  
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<211> 1219

<212> DNA

<213> Streptococcus pneumoniae

<400> 12

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acaattactg tagctctagt taacgagttg aacaacatta agaacgagta tttgaataaa 240
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<210> 13

<211> 1969

<212> DNA

<213> Streptococcus pneumoniae

<400> 13

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gaggaatatg taaaaaaaaat agtgggtgag agctatgcaa aatcaactaa aaagcgacat 180
acaattactg tagctctagt taacgagttg aacaacatta agaacgagta tttgaataaa 240
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tccactaaac cggaagcttc agatacagcg aagccaaaca agccgacaga accaggagaa 420
aaggtagcag aagctaagaa gaaggttgaa gaagctgaga aaaaagccaa ggatcaaaaa 480
gaagaagatc gtcgtaacta cccaaccatt acttacaaaa cgcttgaact tgaaattgct 540
gagtcgagtg tggaagttaa aaaagcggag cttgaactag taaaagttaa agctaacgaa 600
cctcgagacg agcaaaaaat taagcaagca gaagcgaag ttgagagtaa acaagctgag 660
gctacaaggt taaaaaaaaat caagacagat cgtgaagaag cagaagaaga agctaaacga 720
agagcagatg ctaaagagca aggtaaacca aaggggcggg caaacgagg agttcctgga 780
gagctagcaa cacctgataa aaaagaaaaat gatgcgaagt cttcagattc tagcgtaggt 840
gaagaaactc ttccaagccc atccctgaaa ccagaaaaaa aggtagcaga agctgagaag 900

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ccaaccaata cttacaaaac gcttgaactt gaaattgctg agtccgatgt ggaagttaaa 1020
aaagcggagg cttgaactag taaaagagga agctaaggaa cctcgaaacg aggaaaaagt 1080
taagcaagca aaagcggaag ttgagagtaa aaaagctgag gctacaaggt tagaaaaaat 1140
caagacagat cgtaaaaaag cagaagaaga agctaaacga aaagcagcag aagaagataa 1200
agttaaagaa aaaccagctg aacaaccaca accagcgccg gctccaaaag cagaaaaacc 1260
agctccagct ccaaaaccag agaatccagc tgaacaacca aaagcagaaa aaccagctga 1320
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gaaagatgga gatacctggt actatcttga agcatcaggt gctatgaaag caagccaatg 1860
gttcaaagta tcagataaat ggtactatgt caatggctca ggtgcccttg cagtcaacac 1920
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<210> 14
<211> 853
<212> DNA
<213> Streptococcus pneumoniae

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gaggaatatg taaaaaaaat agtgggtgag agctatgcaa aatcaactaa aaagcgacat 180
acaattactg tagctctagt taacgagttg aacaacatta agaacgagta tttgaataaa 240
atagttgaat caacctcaga aagccaacta cagatactga tgatggagag tcgatcaaaa 300
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tccactaaac cggaagcttc agatacagcg aagccaaaca agccgacaga accaggagaa 420
aaggtagcag aagctaagaa gaagggtgaa gaagctgaga aaaaagccaa ggatcaaaaa 480
gaagaagatc gtcgtaacta cccaaccatt acttacaaa cgcttgaact tgaaattgct 540
gagtcgagat tggaagttaa aaaagcggag cttgaaactag taaaagtga agctaacgaa 600
cctcgagacg agcaaaaaat taagcaagca gaagcggag ttgagagtaa acaagctgag 660
gctacaaggt taaaaaaaat caagacagat cgtgaagaag cagaagaaga agctaaacga 720
agagcagatg ctaaagagca aggtaaacca aagggcgagg caaaacgagg agttcctgga 780
gagctagcaa cacctgataa aaaagaaaat gatgcgaagt cttcagattc tagcgtagggt 840
gaagaaactc ttc 853

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<210> 15
<211> 318
<212> DNA
<213> Streptococcus pneumoniae

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<400> 15
aaaccagaaa aaaaggtagc agaagctgag aagaaggttg aagaagctaa gaaaaagcc 60
gaggatcaaa aagaagaaga tcgccgtaac tacccaacca atacttacia aacgcttgaa 120
cttgaaattg ctgagtcgga tgtggaagt aaaaaagcgg agcttgaact agtaaaagag 180
gaagctaagg aacctcgaaa cgaggaaaaa gttaagcaag caaaagcgga agttgagagt 240
aaaaaagctg aggctacaag gttagaaaaa atcaagacag atcgtaaaaa agcagaagaa 300
gaagctaaac gaaaagca 318

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```

<210> 16
<211> 327
<212> DNA

```

<213> Streptococcus pneumoniae

<400> 16  
acagaaccag gagaaaaggt agcagaagct aagaagaagg ttgaagaagc tgagaaaaaa 60  
gccaaggatc aaaaagaaga agatcgctgt aactacccaa ccattactta caaacgctt 120  
gaacttgaaa ttgctgagtc cgatgtggaa gttaaaaaag cggagcttga actagtaaaa 180  
gtgaaagcta acgaacctcg agacgagcaa aaaattaagc aagcagaagc ggaagttgag 240  
agtaacaag ctgaggctac aagggttaaaa aaaatcaaga cagatcgtga agaagcagaa 300  
gaagaagcta aacgaagagc agatgct 327

<210> 17

<211> 1129

<212> DNA

<213> Streptococcus pneumoniae

<400> 17  
gaaaacgaag gaagtaccca agcagccact tcttctaata tggcaaagac agaacatagg 60  
aaagctgcta aacaagtcgt cgatgaatat atagaaaaaa tgttgaggga gattcaacta 120  
gatagaagaa aacataccca aaatgtcgcc ttaaacataa agttgagcgc aattaaaacg 180  
aagtatttgc gtgaattaaa tgttttagaa gagaagtcga aagatgagtt gccgtcagaa 240  
ataaaagcaa agttagacgc agcttttgag aagtttaaaa aagatacatt gaaaccagga 300  
gaaaaggtag cagaagctaa gaagaagggt gaagaagcta agaaaaaagc cgaggatcaa 360  
aaagaagaag atcgctcgtaa ctacccaacc aatacttaca aaacgcttga acttgaaatt 420  
gctgagttcg atgtgaaagt taaagaagcg gagcttgaac tagtaaaaga ggaagctaaa 480  
gaatctcgaa acgagggcac aattaagcaa gcaaaagaga aagttgagag taaaaaagct 540  
gaggctacaa ggtagaaaa catcaagaca gatcgtaaaa aagcagaaga agaagctaaa 600  
cgaaaagcag atgctaagtt gaaggaagct aatgtagcga cttcagatca aggtaaacca 660  
aaggggcggg caaacgagg agttcctgga gagctagcaa cacctgataa aaaagaaaat 720  
gatgcgaagt cttcagattc tagcgtaggt gaagaaactc ttccaagctc atccctgaaa 780  
tcaggaaaaa aggtagcaga agctgagaag aaggttgaag aagctgagaa aaaagccaag 840  
gatcaaaaag aagaagatcg ccgtaactac ccaaccaata cttacaaaac gcttgacctt 900  
gaaatttgctg agtccgatgt gaaagttaaa gaagcggagc ttgaactagt aaaagaggaa 960  
gctaaggaac ctcgagacga ggaaaaaatt aagcaagcaa aagcgaaagt tgagagtaaa 1020  
aaagctgagg ctacaagggt agaaaacatc aagacagatc gtaaaaaagc agaagaagaa 1080  
gctaaacgaa aagcagcaga agaagataaa gttaaagaaa aaccagctg 1129

<210> 18

<211> 1992

<212> DNA

<213> Streptococcus pneumoniae

<400> 18  
gaaaacgaag gaagtaccca agcagccact tcttctaata tggcaaagac agaacatagg 60  
aaagctgcta aacaagtcgt cgatgaatat atagaaaaaa tgttgaggga gattcaacta 120  
gatagaagaa aacataccca aaatgtcgcc ttaaacataa agttgagcgc aattaaaacg 180  
aagtatttgc gtgaattaaa tgttttagaa gagaagtcga aagatgagtt gccgtcagaa 240  
ataaaagcaa agttagacgc agcttttgag aagtttaaaa aagatacatt gaaaccagga 300  
gaaaaggtag cagaagctaa gaagaagggt gaagaagcta agaaaaaagc cgaggatcaa 360  
aaagaagaag atcgctcgtaa ctacccaacc aatacttaca aaacgcttga acttgaaatt 420  
gctgagttcg atgtgaaagt taaagaagcg gagcttgaac tagtaaaaga ggaagctaaa 480  
gaatctcgaa acgagggcac aattaagcaa gcaaaagaga aagttgagag taaaaaagct 540  
gaggctacaa ggtagaaaa catcaagaca gatcgtaaaa aagcagaaga agaagctaaa 600  
cgaaaagcag atgctaagtt gaaggaagct aatgtagcga cttcagatca aggtaaacca 660  
aaggggcggg caaacgagg agttcctgga gagctagcaa cacctgataa aaaagaaaat 720  
gatgcgaagt cttcagattc tagcgtaggt gaagaaactc ttccaagctc atccctgaaa 780  
tcaggaaaaa aggtagcaga agctgagaag aaggttgaag aagctgagaa aaaagccaag 840  
gatcaaaaag aagaagatcg ccgtaactac ccaaccaata cttacaaaac gcttgacctt 900

```

gaaattgctg agtccgatgt gaaagttaaa gaagcggagc ttgaactagt aaaagaggaa 960
gctaaggaac ctcgagacga ggaaaaaatt aagcaagcaa aagcgaaagt tgagagtaaa 1020
aaagctgagg ctacaagggt agaaaacatc aagacagatc gtaaaaaagc agaagaagaa 1080
gctaaacgaa aagcagcaga agaagataaa gttaaagaaa aaccagctga acaaccacaa 1140
ccagcgccgg ctactcaacc agaaaaacca gctccaaaaac cagagaagcc agctgaacaa 1200
ccaaaagcag aaaaaacaga tgatcaacaa gctgaagaag actatgctcg tagatcagaa 1260
gaagaatata atcgcttgac tcaacagcaa ccgccaaaaa ctgaaaaacc agcacaacca 1320
tctactccaa aaacaggctg gaaacaagaa aacgggtatgt ggtacttcta caatactgat 1380
ggttcaatgg caacaggatg gctccaaaac aacggttcat ggtactatct aaacgctaata 1440
ggtgctatgg cgacaggatg gctccaaaac aatggttcat ggtactatct aaacgctaata 1500
ggttcaatgg caacaggatg gctccaaaac aatggttcat ggtactatct aaacgctaata 1560
ggtgctatgg cgacaggatg gctccaatac aatggttcat ggtactacct aaacagcaata 1620
ggcgctatgg cgacaggatg gctccaatac aatggctcat ggtactacct caacgctaata 1680
ggtgatatgg cgacaggatg gctccaaaac aacggttcat ggtactacct caacgctaata 1740
ggtgatatgg cgacaggatg gctccaatac aacggttcat ggtattacct caacgctaata 1800
ggtgatatgg cgacaggatg ggtgaaagat ggagatacct ggtactatct tgaagcatca 1860
ggtgctatga aagcaagcca atgggttcaa gtatcagata aatggtagta tgtcaatggc 1920
tcagggtgcc ttgcagtcaa cacaactgta gatggctatg gagtcaatgc caatggtgaa 1980
tgggtaaact aa 1992

```

<210> 19

<211> 763

<212> DNA

<213> Streptococcus pneumoniae

<400> 19

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gaaaacgaag gaagtaccca agcagccact tcttctaata tggcaaagac agaacatagg 60
aaagctgcta aacaagtcgt cgatgaatat atagaaaaaa tgttgagga gattcaacta 120
gatagaagaa aacataccca aaatgtcgcc ttaaacataa agttgagcgc aattaaaacg 180
aagtatttgc gtgaattaaa tgttttagaa gagaagtcga aagatgagtt gccgtcagaa 240
ataaaagcaa agttagacgc agcttttaga aagtttaaaa aagatacatt gaaaccagga 300
gaaaaggtag cagaagctaa gaagaagggt gaagaagcta agaaaaaagc cgaggatcaa 360
aaagaagaag atcgctgtaa ctaccaacc aatacttaca aaacgcttga acttgaaatt 420
gctgagttcg atgtgaaagt taaagaagcg gagcttgaac tagtaaaaga ggaagctaaa 480
gaatctcgaa acgagggcac aattaagcaa gcaaaagaga aagttgagag taaaaaagct 540
gaggctacaa ggttagaaaa catcaagaca gatcgtaaaa aagcagaaga agaagctaaa 600
cgaaaagcag atgctaagtt gaaggaagct aatgtagcga cttcagatca aggtaaacca 660
aaggggcggg caaaacgagg agttcctgga gagctagcaa cacctgataa aaaagaaaaat 720
gatgcgaagt cttcagattc tagcgtaggt gaagaaactc ttc 763

```

<210> 20

<211> 318

<212> DNA

<213> Streptococcus pneumoniae

<400> 20

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aaatcaggaa aaaaggtagc agaagctgag aagaagggtt aagaagctga gaaaaaagcc 60
aaggatcaaa aagaagaaga tcgccgtaac taccacaacca atacttaca aacgcttgac 120
cttgaaattg ctgagtcgga tgtgaaagtt aaagaagcgg agcttgaact agtaaaagag 180
gaagctaagg aacctcgaga cgaggaaaaa attaagcaag caaaagcgaa agttgagagt 240
aaaaaagctg aggtacaag gttagaaaac atcaagacag atcgtaaaaa agcagaagaa 300
gaagctaaac gaaaagca 318

```

<210> 21

<211> 321

<212> DNA

<213> Streptococcus pneumoniae



<400> 21  
ccaggagaaa aggtagcaga agctaagaag aagggttgaag aagctaagaa aaaagccgag 60  
gatcaaaaag aagaagatcg tcgtaactac ccaaccaata cttacaaaac gcttgaactt 120  
gaaattgctg agttcgatgt gaaagttaaa gaagcggagc ttgaactagt aaaagaggaa 180  
gctaaagaat ctcgaaacga gggcacaatt aagcaagcaa aagagaaaagt tgagagtaaa 240  
aaagctgagg ctacaagggt agaaaacatc aagacagatc gtaaaaaagc agaagaagaa 300  
gctaaacgaa aagcagatgc t 321

<210> 22  
<211> 121  
<212> PRT  
<213> Streptococcus pneumoniae

<400> 22  
Ser Pro Ser Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys  
1 5 10 15  
Val Glu Glu Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg  
20 25 30  
Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala  
35 40 45  
Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu  
50 55 60  
Glu Ala Lys Glu Pro Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala  
65 70 75 80  
Glu Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys  
85 90 95  
Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu  
100 105 110  
Glu Asp Lys Val Lys Glu Lys Pro Ala  
115 120

<210> 23  
<211> 122  
<212> PRT  
<213> Streptococcus pneumoniae

<400> 23  
Pro Ser Ser Ser Leu Lys Ser Gly Lys Lys Val Ala Glu Ala Glu Lys  
1 5 10 15  
Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp  
20 25 30  
Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu Ile  
35 40 45  
Ala Glu Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys  
50 55 60

Glu Glu Ala Lys Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Lys  
 65 70 75 80  
 Ala Lys Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile  
 85 90 95  
 Lys Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala  
 100 105 110  
 Glu Glu Asp Lys Val Lys Glu Lys Arg Ala  
 115 120

<210> 24  
 <211> 428  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 24  
 Glu Asn Glu Gly Ala Thr Gln Val Pro Thr Ser Ser Asn Arg Ala Asn  
 1 5 10 15  
 Glu Ser Gln Ala Glu Gln Gly Glu Gln Pro Lys Lys Leu Asp Ser Glu  
 20 25 30  
 Arg Asp Lys Ala Arg Lys Glu Val Glu Glu Tyr Val Lys Lys Ile Val  
 35 40 45  
 Gly Glu Ser Tyr Ala Lys Ser Thr Lys Lys Arg His Thr Ile Thr Val  
 50 55 60  
 Ala Leu Val Asn Glu Leu Asn Asn Ile Lys Asn Glu Tyr Leu Asn Lys  
 65 70 75 80  
 Ile Val Glu Ser Thr Ser Glu Ser Gln Leu Gln Ile Leu Met Met Glu  
 85 90 95  
 Ser Arg Ser Lys Val Asp Glu Ala Val Ser Lys Phe Glu Lys Asp Ser  
 100 105 110  
 Ser Ser Ser Ser Ser Ser Asp Ser Ser Thr Lys Pro Glu Ala Ser Asp  
 115 120 125  
 Thr Ala Lys Pro Asn Lys Pro Thr Glu Pro Gly Glu Lys Val Ala Glu  
 130 135 140  
 Ala Lys Lys Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys  
 145 150 155 160  
 Glu Glu Asp Arg Arg Asn Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Glu  
 165 170 175  
 Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu  
 180 185 190  
 Leu Val Lys Val Lys Ala Asn Glu Pro Arg Asp Glu Gln Lys Ile Lys



<400> 26  
gccgtcgact tagtttaccc attcaccatt ggc

33

<210> 27  
<211> 5  
<212> PRT  
<213> Streptococcus pneumoniae

<220>  
<221> VARIANT  
<222> (1)  
<223> It could be any amino acid.

<400> 27  
Xaa Glu Asn Glu Gly  
1 5

<210> 28  
<211> 439  
<212> PRT  
<213> Streptococcus pneumoniae

<220>  
<221> VARIANT  
<222> (243)  
<223> It could be any amino acid.

<400> 28  
Ala Val Ala Ser Leu Phe Met Gly Ser Val Val His Ala Thr Glu Lys  
1 5 10 15  
Glu Val Thr Thr Gln Val Ala Thr Ser Ser Asn Lys Ala Asn Lys Ser  
20 25 30  
Gln Thr Glu His Met Lys Ala Ala Lys Gln Val Asp Glu Tyr Ile Lys  
35 40 45  
Lys Lys Leu Gln Leu Asp Arg Arg Lys His Thr Gln Asn Val Gly Leu  
50 55 60  
Leu Thr Lys Leu Gly Val Ile Lys Thr Glu Tyr Leu His Gly Leu Ser  
65 70 75 80  
Val Ser Lys Lys Lys Ser Glu Ala Glu Leu Pro Ser Glu Ile Lys Ala  
85 90 95  
Lys Leu Asp Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr Leu Pro Thr  
100 105 110  
Glu Pro Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala  
115 120 125  
Lys Lys Lys Ala Glu Asp Gln Lys Glu Lys Asp Leu Arg Asn Tyr Pro  
130 135 140

Thr Asn Thr Tyr Lys Thr Leu Glu Leu Asp Ile Ala Glu Ser Asp Val  
 145 150 155 160  
 Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu  
 165 170 175  
 Ser Arg Asp Glu Lys Lys Ile Asn Gln Ala Lys Ala Lys Val Glu Asn  
 180 185 190  
 Lys Lys Ala Glu Ala Thr Arg Leu Lys Asn Ile Lys Thr Asp Arg Glu  
 195 200 205  
 Lys Ala Glu Glu Ala Lys Arg Arg Ala Asp Ala Lys Leu Gln Glu Ala  
 210 215 220  
 Asn Val Ala Thr Ser Glu Gln Asp Lys Ser Lys Arg Arg Ala Lys Arg  
 225 230 235 240  
 Glu Val Xaa Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala  
 245 250 255  
 Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Thr Ser Pro Ser  
 260 265 270  
 Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu  
 275 280 285  
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr  
 290 295 300  
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp  
 305 310 315 320  
 Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys  
 325 330 335  
 Glu Ser Arg Asn Glu Glu Lys Ile Lys Gln Val Lys Ala Lys Val Glu  
 340 345 350  
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg  
 355 360 365  
 Lys Lys Ala Glu Glu Glu Glu Ala Lys Arg Arg Ala Ala Glu Glu Asp  
 370 375 380  
 Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro  
 385 390 395 400  
 Gln Pro Glu Lys Pro Thr Glu Glu Pro Glu Asn Pro Ala Pro Ala Pro  
 405 410 415  
 Ala Pro Lys Pro Glu Asn Pro Ala Glu Lys Pro Lys Ala Glu Lys Pro  
 420 425 430  
 Ala Asp Gln Gln Ala Glu Glu  
 435

<400> 29  
Ala Val Ala Ser Leu Phe Met Gly Ser Val Val His Ala Thr Glu Lys  
1 5 10 15  
Glu Val Thr Thr Gln Val Ala Thr Ser Ser Asn Arg Ala Asn Lys Ser  
20 25 30  
Gln Thr Glu His Met Lys Ala Ala Lys Gln Val Asp Glu Tyr Ile Lys  
35 40 45  
Lys Lys Leu Gln Leu Asp Arg Arg Lys His Thr Gln Asn Val Gly Leu  
50 55 60  
Leu Thr Lys Leu Gly Val Ile Lys Thr Glu Tyr Leu His Gly Leu Ser  
65 70 75 80  
Val Ser Lys Lys Lys Ser Glu Ala Glu Leu Pro Ser Glu Ile Lys Ala  
85 90 95  
Lys Leu Asp Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr Leu Pro Thr  
100 105 110  
Glu Pro Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala  
115 120 125  
Lys Lys Lys Ala Glu Asp Gln Lys Glu Lys Asp Leu Arg Asn Tyr Pro  
130 135 140  
Thr Asn Thr Tyr Lys Thr Leu Glu Leu Asp Ile Ala Glu Ser Asp Val  
145 150 155 160  
Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu  
165 170 175  
Ser Arg Asp Glu Lys Lys Ile Asn Gln Ala Lys Ala Lys Val Glu Asn  
180 185 190  
Lys Lys Ala Glu Ala Thr Arg Leu Lys Asn Ile Lys Thr Asp Arg Glu  
195 200 205  
Lys Ala Glu Glu Ala Lys Arg Arg Ala Asp Ala Lys Leu Gln Glu Ala  
210 215 220  
Asn Val Ala Thr Ser Glu Gln Asp Lys Ser Lys Arg Arg Ala Lys Arg  
225 230 235 240  
Glu Val Leu Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala  
245 250 255  
Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Thr Ser Pro Ser  
260 265 270

Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu  
 275 280 285  
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr  
 290 295 300  
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp  
 305 310 315 320  
 Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys  
 325 330 335  
 Glu Ser Arg Asn Glu Glu Lys Ile Lys Gln Val Lys Ala Lys Val Glu  
 340 345 350  
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg  
 355 360 365  
 Lys Lys Ala Glu Glu Glu Glu Ala Lys Arg Arg Ala Ala Glu Glu Asp  
 370 375 380  
 Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro  
 385 390 395 400  
 Gln Pro Glu Lys Pro Thr Glu Glu Pro Glu Asn Pro Ala Pro Ala Pro  
 405 410 415  
 Ala Pro Lys Pro Glu Asn Pro Ala Glu Lys Pro Lys Ala Glu Lys Pro  
 420 425 430  
 Ala Asp Gln Gln Ala  
 435  
  
 <210> 30  
 <211> 439  
 <212> PRT  
 <213> Streptococcus pneumoniae  
  
 <400> 30  
 Val Ala Val Ala Ser Leu Val Met Gly Ser Val Val His Ala Thr Glu  
 1 5 10 15  
 Lys Glu Val Thr Thr Gln Val Ala Thr Ser Ser Asn Arg Ala Asn Glu  
 20 25 30  
 Ser Gln Ala Gly His Arg Lys Ala Ala Glu Gln Phe Asp Glu Tyr Ile  
 35 40 45  
 Lys Thr Met Ile Gln Leu Asp Arg Arg Lys His Thr Gln Asn Phe Ala  
 50 55 60  
 Leu Asn Ile Lys Leu Ser Arg Ile Lys Thr Glu Tyr Leu Arg Lys Leu  
 65 70 75 80  
 Asn Val Leu Glu Glu Lys Ser Lys Ala Glu Leu Pro Ser Glu Thr Lys

85 90 95  
 Lys Glu Ile Asp Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr Asn Arg  
 100 105 110  
 Thr Lys Lys Thr Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala Lys  
 115 120 125  
 Lys Lys Ala Lys Ala Gln Lys Glu Glu Asp His Arg Asn Tyr Pro Thr  
 130 135 140  
 Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val Glu  
 145 150 155 160  
 Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu Ser  
 165 170 175  
 Arg Asp Asp Glu Lys Ile Lys Gln Ala Glu Ala Lys Val Glu Ser Lys  
 180 185 190  
 Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg Glu Lys  
 195 200 205  
 Ala Glu Glu Glu Ala Lys Arg Arg Ala Glu Ala Lys Leu Lys Glu Ala  
 210 215 220  
 Val Glu Lys Asn Val Ala Thr Ser Glu Gln Asp Lys Pro Lys Gly Arg  
 225 230 235 240  
 Arg Lys Arg Gly Val Pro Gly Glu Gln Ala Thr Pro Asp Lys Lys Glu  
 245 250 255  
 Asn Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Ala Leu Pro  
 260 265 270  
 Ser Pro Ser Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys  
 275 280 285  
 Val Ala Glu Ala Glu Lys Lys Ala Lys Ala Gln Lys Glu Glu Asp Arg  
 290 295 300  
 Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala  
 305 310 315 320  
 Glu Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu  
 325 330 335  
 Glu Ala Lys Glu Ser Arg Asn Glu Glu Lys Val Asn Gln Ala Lys Ala  
 340 345 350  
 Lys Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys  
 355 360 365  
 Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu  
 370 375 380  
 Glu Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro





Glu Glu Glu Ala Lys Arg Arg Val Asp Ala Lys Glu Gln Asp Glu Ser  
 210 215 220  
 Ser Lys Arg Arg Lys Ser Arg Val Lys Arg Gly Asp Val Gly Glu Gln  
 225 230 235 240  
 Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala Lys Ser Ser Asp Ser Ser  
 245 250 255  
 Val Gly Glu Glu Thr Leu Pro Ser Pro Ser Leu Lys Pro Gly Lys Lys  
 260 265 270  
 Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala Asp Lys Lys Ala Lys  
 275 280 285  
 Ala Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys  
 290 295 300  
 Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala  
 305 310 315 320  
 Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu Pro Arg Asn Glu Glu  
 325 330 335  
 Lys Val Lys Gln Ala Lys Ala Glu Val Glu Ser Lys Lys Ala Glu Ala  
 340 345 350  
 Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg Lys Lys Ala Glu Glu Glu  
 355 360 365  
 Ala Lys Arg Lys Ala Ala Glu Glu Asp Lys Val Lys Glu Lys Pro Ala  
 370 375 380  
 Glu Gln Pro Lys Pro Ala Pro Ala Pro Gln Pro Glu Lys Pro Ala Pro  
 385 390 395 400  
 Lys Pro Glu Asn Pro Ala Glu Gln Pro Lys Ala Glu Lys Pro Ala Asp  
 405 410 415  
 Gln Gln Ala

<210> 32  
 <211> 437  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 32  
 Val Ala Ser Leu Phe Met Gly Ser Val Val His Ala Thr Glu Lys Glu  
 1 5 10 15  
 Val Thr Thr Gln Val Ala Thr Ser Ser Asn Lys Ala Asn Lys Ser Gln  
 20 25 30  
 Thr Glu His Met Lys Ala Ala Lys Gln Val Asp Glu Tyr Ile Lys Lys  
 35 40 45

Lys Leu Gln Leu Asp Arg Arg Lys His Thr Gln Asn Val Gly Leu Leu  
 50 55 60  
 Thr Lys Leu Gly Val Ile Lys Thr Glu Tyr Leu His Gly Leu Ser Val  
 65 70 75 80  
 Ser Lys Lys Lys Ser Glu Ala Glu Leu Pro Ser Glu Ile Lys Ala Lys  
 85 90 95  
 Leu Asp Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr Leu Pro Thr Glu  
 100 105 110  
 Pro Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala Lys  
 115 120 125  
 Lys Lys Ala Glu Asp Gln Lys Glu Lys Asp Leu Arg Asn Tyr Pro Thr  
 130 135 140  
 Asn Thr Tyr Lys Thr Leu Glu Leu Asp Ile Ala Glu Ser Asp Val Glu  
 145 150 155 160  
 Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu Ser  
 165 170 175  
 Arg Asp Glu Lys Lys Ile Asn Gln Ala Lys Ala Lys Val Glu Asn Lys  
 180 185 190  
 Lys Ala Glu Ala Thr Arg Leu Lys Asn Ile Lys Thr Asp Arg Glu Lys  
 195 200 205  
 Ala Glu Glu Ala Lys Arg Arg Ala Asp Ala Lys Leu Gln Glu Ala Asn  
 210 215 220  
 Val Ala Thr Ser Glu Gln Asp Lys Ser Lys Arg Arg Ala Lys Arg Glu  
 225 230 235 240  
 Val Phe Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala Lys  
 245 250 255  
 Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Thr Ser Pro Ser Leu  
 260 265 270  
 Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala  
 275 280 285  
 Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro  
 290 295 300  
 Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val  
 305 310 315 320  
 Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu  
 325 330 335  
 Ser Arg Asn Glu Glu Lys Ile Lys Gln Val Lys Ala Lys Val Glu Ser  
 340 345 350

Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg Lys  
 355 360 365

Lys Ala Glu Glu Glu Glu Ala Lys Arg Arg Ala Ala Glu Glu Asp Lys  
 370 375 380

Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro Gln  
 385 390 395 400

Pro Glu Lys Pro Thr Glu Glu Pro Glu Asn Pro Ala Pro Ala Pro Ala  
 405 410 415

Pro Lys Pro Glu Asn Pro Ala Glu Lys Pro Lys Ala Glu Lys Pro Ala  
 420 425 430

Asp Gln Gln Ala Glu  
 435

<210> 33

<211> 433

<212> PRT

<213> Streptococcus pneumoniae

<400> 33

Cys Thr Val Ala Ser Leu Val Met Gly Ser Val Val His Ala Thr Glu  
 1 5 10 15

Asn Glu Arg Thr Thr Gln Val Pro Thr Ser Ser Asn Arg Gly Lys Pro  
 20 25 30

Glu Arg Arg Lys Ala Ala Glu Gln Phe Asp Glu Tyr Ile Asn Lys Met  
 35 40 45

Ile Gln Leu Asp Lys Arg Lys His Thr Gln Asn Leu Ala Phe Asn Ile  
 50 55 60

Gln Leu Ser Arg Ile Lys Thr Glu Tyr Leu Asn Gly Leu Lys Glu Lys  
 65 70 75 80

Ser Glu Ala Glu Leu Pro Ser Lys Ile Lys Ala Glu Leu Asp Ala Ala  
 85 90 95

Phe Lys Gln Phe Lys Lys Asp Thr Leu Pro Thr Glu Pro Glu Lys Lys  
 100 105 110

Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala Glu Lys Lys Val Ala  
 115 120 125

Glu Ala Lys Lys Lys Ala Lys Ala Gln Lys Glu Glu Asp His Arg Asn  
 130 135 140

Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Asp Leu Glu Ile Ala Glu Phe  
 145 150 155 160

Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Lys Glu Ala



<213> Streptococcus pneumoniae

<400> 34

Val Ala Val Ala Ser Leu Val Met Gly Ser Val Val His Ala Thr Glu  
1 5 10 15  
Lys Glu Val Thr Thr Gln Val Pro Thr Tyr Ser Asn Met Ala Lys Thr  
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Glu His Arg Lys Ala Ala Lys Gln Val Val Asp Glu Tyr Ile Glu Lys  
35 40 45  
Met Leu Arg Glu Ile Gln Leu Asp Arg Arg Lys His Thr Gln Asn Phe  
50 55 60  
Ala Phe Asn Met Lys Leu Ser Ala Ile Lys Thr Glu Tyr Leu Tyr Gly  
65 70 75 80  
Leu Lys Glu Lys Ser Glu Ala Glu Leu Pro Ser Glu Val Lys Ala Lys  
85 90 95  
Leu Asp Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr Leu Lys Leu Gly  
100 105 110  
Glu Lys Val Ala Glu Ala Glu Lys Lys Val Ala Glu Ala Glu Lys Lys  
115 120 125  
Ala Lys Ala Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro Thr Asn Thr  
130 135 140  
Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys  
145 150 155 160  
Lys Ala Glu Leu Glu Leu Leu Lys Glu Glu Ala Lys Thr Arg Asn Glu  
165 170 175  
Asp Thr Ile Asn Gln Ala Lys Ala Lys Val Glu Ser Lys Lys Ala Glu  
180 185 190  
Ala Thr Lys Leu Glu Glu Ile Lys Thr Asp Arg Lys Lys Ala Glu Glu  
195 200 205  
Glu Ala Lys Arg Lys Ala Glu Ala Glu Glu Asp Lys Val Lys Asp Lys  
210 215 220  
Leu Lys Arg Arg Thr Lys Arg Ala Val Pro Gly Glu Pro Ala Thr Pro  
225 230 235 240  
Asp Lys Lys Glu Asn Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu  
245 250 255  
Glu Thr Leu Pro Ser Pro Ser Leu Lys Ser Gly Lys Lys Val Ala Glu  
260 265 270  
Ala Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys  
275 280 285

Glu Glu Asp Arg Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp  
 290 295 300  
 Leu Glu Ile Ala Glu Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu  
 305 310 315 320  
 Leu Val Lys Glu Glu Ala Lys Gly Ser Arg Asn Glu Glu Lys Ile Asn  
 325 330 335  
 Gln Ala Lys Ala Glu Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu  
 340 345 350  
 Glu Lys Ile Lys Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg  
 355 360 365  
 Lys Ala Ala Glu Glu Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro  
 370 375 380  
 Gln Pro Ala Pro Ala Pro Gln Pro Glu Lys Pro Thr Glu Glu Pro Glu  
 385 390 395 400  
 Asn Pro Ala Pro Ala Pro Lys Pro Glu Lys Pro Ala Glu Gln Pro Lys  
 405 410 415  
 Ala Glu Lys Thr Asp Asp Gln Gln Ala Glu Glu  
 420 425  
  
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 <211> 413  
 <212> PRT  
 <213> Streptococcus pneumoniae  
  
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 20 25 30  
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 35 40 45  
 Val Ala Leu Asn Ile Lys Leu Ser Ala Ile Lys Thr Lys Tyr Leu Arg  
 50 55 60  
 Glu Leu Asn Val Leu Glu Glu Lys Ser Lys Asp Glu Leu Pro Ser Glu  
 65 70 75 80  
 Ile Lys Ala Lys Leu Asp Ala Ala Phe Glu Lys Phe Lys Lys Asp Thr  
 85 90 95  
 Leu Lys Pro Gly Glu Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu  
 100 105 110  
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr  
 115 120 125

Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Phe Asp  
 130 135 140  
 Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys  
 145 150 155 160  
 Glu Ser Arg Asn Glu Gly Thr Ile Lys Gln Ala Lys Glu Lys Val Glu  
 165 170 175  
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg  
 180 185 190  
 Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Asp Ala Lys Leu Lys  
 195 200 205  
 Glu Ala Asn Val Ala Thr Ser Asp Gln Gly Lys Pro Lys Gly Arg Ala  
 210 215 220  
 Lys Arg Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn  
 225 230 235 240  
 Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser  
 245 250 255  
 Ser Ser Leu Lys Ser Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val  
 260 265 270  
 Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu Glu Asp Arg Arg  
 275 280 285  
 Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Asp Leu Glu Ile Ala Glu  
 290 295 300  
 Ser Asp Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Glu Glu  
 305 310 315 320  
 Ala Lys Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Lys Ala Lys  
 325 330 335  
 Val Glu Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr  
 340 345 350  
 Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu  
 355 360 365  
 Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala  
 370 375 380  
 Thr Gln Pro Glu Lys Pro Ala Pro Lys Pro Glu Lys Pro Ala Glu Gln  
 385 390 395 400  
 Pro Lys Ala Glu Lys Thr Asp Asp Gln Gln Ala Glu Glu  
 405 410

<210> 36



<211> 425  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 36  
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             20                    25                    30  
 Lys Lys Tyr Ala Asp Glu Val Lys Ser His Leu Glu Lys Ile Leu Ser  
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 Glu Ile Gln Thr Asn Leu Asp Arg Ser Lys His Ile Lys Thr Val Asn  
             50                    55                    60  
 Leu Ile Asn Lys Leu Gln Asp Ile Lys Arg Thr Tyr Leu Tyr Glu Leu  
             65                    70                    75                    80  
 Asn Val Leu Glu Asp Lys Ser Lys Ala Glu Leu Pro Ser Lys Ile Lys  
             85                    90                    95  
 Ala Glu Leu Asp Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr Leu Pro  
             100                    105                    110  
 Thr Glu Pro Gly Lys Lys Val Ala Glu Ala Lys Lys Lys Val Glu Glu  
             115                    120                    125  
 Ala Glu Lys Lys Ala Lys Ala Gln Lys Glu Glu Asp Tyr Arg Asn Tyr  
             130                    135                    140  
 Pro Thr Ile Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp  
             145                    150                    155                    160  
 Val Lys Val Lys Glu Ala Glu Leu Glu Leu Val Lys Lys Glu Ala Asp  
             165                    170                    175  
 Glu Ser Arg Asn Glu Gly Thr Ile Asn Gln Ala Lys Ala Lys Val Glu  
             180                    185                    190  
 Ser Glu Gln Ala Glu Ala Thr Arg Leu Lys Lys Ile Lys Thr Asp Arg  
             195                    200                    205  
 Glu Lys Ala Glu Glu Glu Ala Lys Arg Arg Ala Asp Ala Lys Glu Gln  
             210                    215                    220  
 Asp Glu Ser Lys Arg Arg Lys Ser Arg Val Lys Arg Gly Asp Phe Gly  
             225                    230                    235                    240  
 Glu Pro Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala Lys Ser Ser Asp  
             245                    250                    255  
 Ser Ser Val Gly Glu Glu Thr Leu Pro Ser Pro Ser Leu Lys Pro Gly  
             260                    265                    270  
 Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala Glu Lys Lys

275                      280                      285  
 Ala Lys Asp Gln Lys Glu Glu Asp His Arg Asn Tyr Pro Thr Ile Thr  
     290                      295                      300  
 Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val Glu Val Lys  
 305                      310                      315  
 Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Gly Ser Arg Asn  
                     325                      330                      335  
 Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu Ser Lys Lys Ala  
                     340                      345                      350  
 Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg Lys Lys Ala Glu  
                     355                      360                      365  
 Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu Asp Lys Val Lys Glu Lys  
                     370                      375                      380  
 Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro Gln Pro Glu Lys Pro  
 385                      390                      395                      400  
 Ala Pro Ala Pro Lys Pro Glu Asn Pro Ala Glu Gln Pro Lys Ala Glu  
                     405                      410                      415  
 Lys Pro Ala Asp Gln Gln Ala Glu Glu  
                     420                      425  
  
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 <211> 439  
 <212> PRT  
 <213> Streptococcus pneumoniae  
  
 <400> 37  
 Ala Ser Leu Phe Leu Gly Gly Val Val His Ala Glu Gly Val Arg Ser  
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                     20                      25                      30  
 Tyr Ala Asp Glu Val Glu Ser His Leu Gln Ser Ile Leu Lys Asp Val  
                     35                      40                      45  
 Asn Lys Asn Leu Lys Lys Val Gln His Thr Gln Asn Ala Asp Phe Asn  
     50                      55                      60  
 Lys Lys Leu Ser Lys Ile Lys Thr Lys Tyr Leu Tyr Glu Leu Asn Val  
     65                      70                      75                      80  
 Leu Glu Glu Lys Ser Glu Ala Glu Leu Thr Ser Lys Thr Lys Glu Thr  
                     85                      90                      95  
 Lys Glu Glu Leu Thr Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr Leu  
                     100                      105                      110

Ser Thr Glu Pro Glu Lys Lys Val Ala Glu Ala Lys Lys Lys Val Glu  
 115 120 125  
 Glu Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Lys Asp Arg Arg Asn  
 130 135 140  
 Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser  
 145 150 155 160  
 Asp Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Val Lys Ala  
 165 170 175  
 Asn Glu Pro Arg Asp Glu Glu Lys Ile Lys Gln Ala Glu Ala Lys Val  
 180 185 190  
 Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu Lys Lys Ile Lys Thr Asp  
 195 200 205  
 Arg Glu Gln Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys Thr Asp Arg  
 210 215 220  
 Glu Gln Ala Glu Glu Glu Ala Lys Val Lys Asp Glu Pro Lys Lys Arg  
 225 230 235 240  
 Thr Lys Arg Gly Val Leu Gly Glu Pro Ala Thr Pro Asp Lys Lys Glu  
 245 250 255  
 Asn Asp Ala Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro  
 260 265 270  
 Ser Pro Ser Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys  
 275 280 285  
 Val Glu Glu Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg  
 290 295 300  
 Arg Asn Tyr Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala  
 305 310 315 320  
 Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu  
 325 330 335  
 Glu Ala Lys Glu Pro Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala  
 340 345 350  
 Glu Val Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu Glu Asn Ile Lys  
 355 360 365  
 Thr Asp Arg Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu  
 370 375 380  
 Glu Asp Lys Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro  
 385 390 395 400  
 Ala Pro Gln Pro Glu Lys Pro Ala Pro Lys Pro Glu Lys Pro Ala Pro  
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Ala Pro Lys Pro Glu Asn Pro Ala Glu Gln Pro Lys Ala Glu Lys Pro  
 420 425 430

Ala Asp Gln Gln Ala Glu Glu  
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<210> 38  
 <211> 460  
 <212> PRT  
 <213> Streptococcus pneumoniae

<400> 38  
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 20 25 30  
 Ser Gln Ala Glu Gln Gly Glu Gln Pro Lys Lys Leu Asp Ser Glu Arg  
 35 40 45  
 Asp Lys Ala Arg Lys Glu Val Glu Glu Tyr Val Lys Lys Ile Val Gly  
 50 55 60  
 Glu Ser Tyr Ala Lys Ser Thr Lys Lys Arg His Thr Ile Thr Val Ala  
 65 70 75 80  
 Leu Val Asn Glu Leu Asn Asn Ile Lys Asn Glu Tyr Leu Asn Lys Ile  
 85 90 95  
 Val Glu Ser Thr Ser Glu Ser Gln Leu Gln Ile Leu Met Met Glu Ser  
 100 105 110  
 Arg Ser Lys Val Asp Glu Ala Val Ser Lys Phe Glu Lys Asp Ser Ser  
 115 120 125  
 Ser Ser Ser Ser Ser Asp Ser Ser Thr Lys Pro Glu Ala Ser Asp Thr  
 130 135 140  
 Ala Lys Pro Asn Lys Pro Thr Glu Pro Gly Glu Lys Val Ala Glu Ala  
 145 150 155 160  
 Lys Lys Lys Val Glu Glu Ala Glu Lys Lys Ala Lys Asp Gln Lys Glu  
 165 170 175  
 Glu Asp Arg Arg Asn Tyr Pro Thr Ile Thr Tyr Lys Thr Leu Glu Leu  
 180 185 190  
 Glu Ile Ala Glu Ser Asp Val Glu Val Lys Lys Ala Glu Leu Glu Leu  
 195 200 205  
 Val Lys Val Lys Ala Asn Glu Pro Arg Asp Glu Gln Lys Ile Lys Gln  
 210 215 220  
 Ala Glu Ala Glu Val Glu Ser Lys Gln Ala Glu Ala Thr Arg Leu Lys  
 225 230 235 240

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<210> 39
<211> 459
<212> PRT
<213> Streptococcus pneumoniae

<400> 39
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Gln Ala Glu Gln Gly Glu Gln Pro Lys Lys Leu Asp Ser Glu Arg Asp

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35					40					45								
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Ser	Tyr	Ala	Lys	Ser	Thr	Lys	Lys	Arg	His	Thr	Ile	Thr	Val	Ala	Leu			
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Val	Asn	Glu	Leu	Asn	Asn	Ile	Lys	Asn	Glu	Tyr	Leu	Asn	Lys	Ile	Val			
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Glu	Ser	Thr	Ser	Glu	Ser	Gln	Leu	Gln	Ile	Leu	Met	Met	Glu	Ser	Arg			
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Asp	Arg	Arg	Asn	Tyr	Pro	Thr	Ile	Thr	Tyr	Lys	Thr	Leu	Glu	Leu	Glu			
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Ile	Ala	Glu	Ser	Asp	Val	Glu	Val	Lys	Lys	Ala	Glu	Leu	Glu	Leu	Val			
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Lys	Val	Lys	Ala	Asn	Glu	Pro	Arg	Asp	Lys	Gln	Lys	Ile	Lys	Gln	Ala			
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Glu	Ala	Glu	Val	Glu	Ser	Lys	Gln	Ala	Glu	Ala	Thr	Arg	Leu	Lys	Lys			
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Ile	Lys	Thr	Asp	Arg	Glu	Glu	Ala	Glu	Glu	Glu	Ala	Lys	Arg	Arg	Ala			
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Asp	Ala	Lys	Glu	Gln	Gly	Lys	Pro	Lys	Gly	Arg	Pro	Lys	Arg	Gly	Val			
					260					265					270			
Pro	Gly	Glu	Leu	Ala	Thr	Pro	Asp	Lys	Lys	Glu	Asn	Asp	Ala	Lys	Ser			
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Ser	Asp	Ser	Ser	Val	Gly	Glu	Glu	Thr	Leu	Pro	Ser	Pro	Ser	Leu	Lys			
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Pro	Glu	Lys	Lys	Val	Ala	Glu	Ala	Glu	Lys	Lys	Val	Glu	Glu	Ala	Lys			
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Lys	Lys	Ala	Glu	Asp	Gln	Lys	Glu	Glu	Asp	Arg	Arg	Asn	Tyr	Pro	Thr			
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Asn	Thr	Tyr	Lys	Thr	Leu	Glu	Leu	Glu	Ile	Ala	Glu	Ser	Asp	Val	Glu			

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Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu Ser Lys		
370	375	380
Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg Lys Lys		
385	390	395
Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu Asp Lys Val Lys		
405	410	415
Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro Lys Thr Glu		
420	425	430
Lys Pro Ala Pro Ala Pro Lys Pro Glu Asn Pro Ala Glu Gln Pro Lys		
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 <211> 437  
 <212> PRT  
 <213> Artificial Sequence

<220>  
 <223> consensus sequence

<400> 40  
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 Gln Thr Glu His Arg Lys Ala Ala Lys Gln Val Asp Glu Tyr Ile Lys  
 35 40 45  
 Lys Met Leu Gln Leu Asp Arg Arg Lys His Thr Gln Asn Val Ala Leu  
 50 55 60  
 Asn Thr Lys Leu Ser Ala Ile Lys Thr Glu Tyr Leu Asn Gly Leu Ser  
 65 70 75 80  
 Val Leu Glu Glu Lys Ser Glu Ala Glu Leu Pro Ser Glu Ile Lys Ala  
 85 90 95  
 Lys Leu Asp Ala Ala Phe Glu Gln Phe Lys Lys Asp Thr Leu Pro Thr  
 100 105 110  
 Glu Pro Gly Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu Ala  
 115 120 125

Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr Pro  
 130 135 140  
 Thr Ile Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp Val  
 145 150 155 160  
 Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys Glu  
 165 170 175  
 Ser Arg Asp Glu Gly Lys Ile Asn Gln Ala Lys Ala Lys Val Glu Ser  
 180 185 190  
 Lys Lys Ala Glu Ala Thr Arg Leu Lys Lys Ile Lys Thr Asp Arg Glu  
 195 200 205  
 Lys Ala Glu Glu Glu Ala Lys Arg Arg Ala Asp Ala Lys Leu Gln Glu  
 210 215 220  
 Ala Asn Val Ala Ser Glu Gln Asp Lys Pro Lys Gly Arg Ala Lys Arg  
 225 230 235 240  
 Gly Val Pro Gly Glu Leu Ala Thr Pro Asp Lys Lys Glu Asn Asp Ala  
 245 250 255  
 Lys Ser Ser Asp Ser Ser Val Gly Glu Glu Thr Leu Pro Ser Pro Ser  
 260 265 270  
 Leu Lys Pro Glu Lys Lys Val Ala Glu Ala Glu Lys Lys Val Glu Glu  
 275 280 285  
 Ala Lys Lys Lys Ala Glu Asp Gln Lys Glu Glu Asp Arg Arg Asn Tyr  
 290 295 300  
 Pro Thr Asn Thr Tyr Lys Thr Leu Glu Leu Glu Ile Ala Glu Ser Asp  
 305 310 315 320  
 Val Glu Val Lys Lys Ala Glu Leu Glu Leu Val Lys Glu Glu Ala Lys  
 325 330 335  
 Glu Ser Arg Asn Glu Glu Lys Val Lys Gln Ala Lys Ala Glu Val Glu  
 340 345 350  
 Ser Lys Lys Ala Glu Ala Thr Arg Leu Glu Lys Ile Lys Thr Asp Arg  
 355 360 365  
 Lys Lys Ala Glu Glu Glu Ala Lys Arg Lys Ala Ala Glu Glu Asp Lys  
 370 375 380  
 Val Lys Glu Lys Pro Ala Glu Gln Pro Gln Pro Ala Pro Ala Pro Gln  
 385 390 395 400  
 Pro Glu Lys Pro Ala Glu Glu Pro Glu Asn Pro Ala Pro Ala Pro Pro  
 405 410 415  
 Lys Pro Glu Asn Pro Ala Glu Gln Pro Lys Ala Glu Lys Pro Ala Asp  
 420 425 430



Gln Gln Ala Glu Glu  
435